

Model LBC³

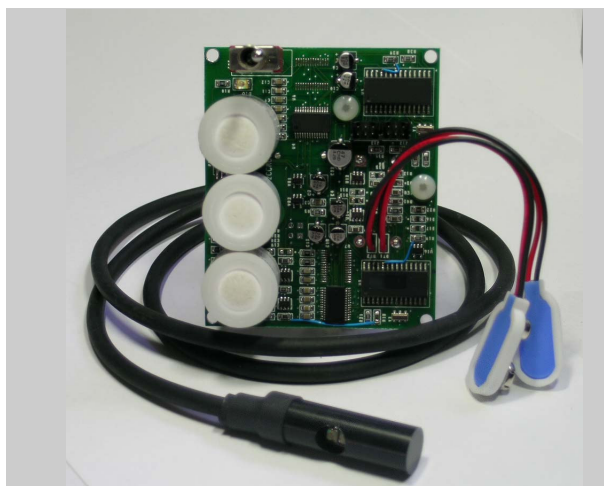
High Reliability Breathing Loop Controller

Battery Operated

Setpoint range from .10ata to 1.6ata

Scalable Redundancy

- ▶ **Surface Rebreathing Systems**
- ▶ **Normoxic Rebreathing Systems**
- ▶ **Mixed Gas Rebreathing Systems**
- ▶ **Other Oxygen Controlled Systems**



Description

The Land Based Mixed Gas Closed Circuit Controller (LBC³) rebreather is a patent pending oxygen measuring and mixing system. The device is designed for applications and systems where it is desirable to maintain a stable Oxygen environment with low levels of operator oversight and training.

The control has been designed to eliminate single points of failure and incorporate full redundancy for all circuit elements—including the power supply. The LBC³ enables continued operation with no user awareness or involvement if hardware, firmware, sensor or even the power supply fails.

Operator interaction is minimal, making this controller a simple go/no-go operation for the user. All operational information is translated into duration based feedback. Complex user interaction for system diagnosis, calibration or operation is eliminated. It is ideal for demanding rebreather applications where the operator is already task loaded. The controller is self compensating for any system failure, eliminating user awareness or involvement.

No other system in the world has packed so many features with so much attention to the usability and end-user use as our LBC³

Features

- ▶ **Low Power (9v Battery) operation.**
- ▶ **Scalable failover protection including power supply and CPU.**
- ▶ **Self Calibrating.**
- ▶ **1 to 3 O₂ Sensor capable.**
- ▶ **CO₂ Sensor capable.**
- ▶ **Depth Sensor capable.**
- ▶ **Altitude sensing and correction.**
- ▶ **Oxygen Supply sensing.**
- ▶ **Diluent Supply sensing capable.**
- ▶ **PASS monitoring capable.**
- ▶ **Scrubber removal/insertion detection.**
- ▶ **Scrubber time available reporting.**
- ▶ **Case Open/Close detection.**
- ▶ **Auto On/Off.**
- ▶ **Single LED user (HUD) interface.**
- ▶ **Minimal operator controls required.**
- ▶ **Programmable Oxygen setpoint (0.15 to 1.60 pO₂).**
- ▶ **Diagnostic and Historical data recording.**
- ▶ **Custom layouts available for user specific applications.**

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Operational Mode Visual Indications and Meanings

LED State	Meaning	Notes
Slow Blink	System OK	System is Controlling Oxygen to the programmed set-point, internal/external parameters are within limits and available scrubber time is OK.
Double Blink	Short Time	20% of scrubber time is remaining.
Triple Blink	Very Short Time	Less than 5 minutes of scrubber time is remaining.
Rapid Blink	Bail Out	There is no usable scrubber time remaining. .

The available runtime duration will be shortened in response to multiple and/or redundant system failures in power supplies, processors, solenoid circuits, sensors and/or other redundant system components.

All system detected events and internal/external sensor information is analyzed, interpreted and translated to a user indication that is related to “usable time left” on the system. During the Operational State, errors in sensor limits, hardware failures and errors in software function are all interpreted and handled by the controller and corrected by fault tolerant design such that the users Oxygen level is maintained. Therefore, the LBC³ allows a user to complete a mission and remains fully functional despite any single points of failure in the controller system. and does so, transparently to the user.

Operational Controls

The LBC³ will automatically start when the Oxygen cylinder valve is opened.

No specific controls or switches are necessary to operate this system. Likewise, to turn the system off the user simply turns off the supply gas AND stops using the system. As a failsafe mechanism, the controller will only shutdown after determining there is no one using the system.

Diagnostic Mode Visual Indications and Meanings

LED State	Action	Description
Solid On	Calibrating	Ambient gas analysis.
Slow Blink	System OK	System is calibrated and has passed diagnostic tests. System will remain in this display mode for 30 seconds and then turn off.
Dot-Dash Blink	Sensors Unstable	Either the ambient air or the sensors are unstable. Allow sensors to flush with ambient air.
Double Blink	Replace Sensors	Sensor(s) are out of manufacturer specified range.
Triple Blink	Replace Battery	Battery(s) are too low to guarantee complete runtime.
Quad Blink	Oxygen is on	Turn Oxygen off for diagnostic testing and calibration.
Rapid Blink	Replace Module	Serious module failure. Replace controller module.

Diagnostic Mode is entered automatically upon detection of scrubber insertion, or removal. During diagnostic mode the system checks all of its internal subsystems and internal/external sensors for functional validation. Next, the system attempts to calibrate itself and upon successful calibration the controller will automatically turn itself off. When the oxygen is turned back on, the system will start and enter the Operational Mode.

For complete operational/diagnostic details—please refer to the complete LBC³ Manual

Ergonomics

The LBC³ Controller has been designed to eliminate all unnecessary user interaction as much as possible. This includes the elimination of all internal/external user activated switches as well as unnecessary displays. State detection switches for scrubber replacement and gas supply presence have been built into the system and can be integrated into the module to allow for no-user-action-required mode detection other than turning on or off the gas and inserting and removing the scrubber canister.

All system status information is transmitted to the user via the heads-up-display (HUD) which is a simple, redundant, single LED indicator.

Parameter	Min	Typical	Max	Units	Notes
Supply Voltage	3		24	Vdc	Subject to Solenoid selection
Supply Current—during On state			2	mA	
Supply Current—during Off state	2		10	uA	
Battery Life Operational	100			hr	Standard 9v alkaline
Battery Life—storage with 100hour reserve	1			yr	Standard 9v alkaline
Low Supply Voltage Warning		<20%			Of operating life—programmable
Critical Supply Voltage Condition Warning	5			V	Programmable
Oxygen Setpoint	.10	.24	1.6	AT Amb	Programmable
Low PO2 Warning	.10	.17	1.5	AT Amb	Programmable
High PO2 Warning	.10	.30	1.6	AT Amb	Programmable
PO2 Resolution		.01		ATA	PPO2
CO2 Sensing Range	0%		5%		Dependant upon sensor selection
Altitude Sensing Range	0		10000	Ft	In 1000ft increments
O2 Supply “On” pressure	15	25	30	psig	Subject to Solenoid and switch selection
O2 Supply “Off” pressure		<15		psig	Subject to Solenoid and switch selection
Data burst baud rate	2.4K	96K	119K	baud	
Keep-alive Oxygen flow rate	.5	4	10	Lpm	Programmable
Sleep timeout		5		min	On detection of AutoPowerDown
Scrubber timer	5min		24hrs	used	
1st Scrubber Depletion Warning		20%		used	Of maximum time
2nd Scrubber Depletion Warning		5		min	Remaining
Scrubber Depletion Alarm		0		min	Remaining
Self Calibration time	30sec	1min	5min		Time to complete self-calibration

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